UNIVERSITY OF JAFFNA, SRI LANKA

FIRST EXAMINATION FOR MEDICAL DEGREES (1ST) - MARCH 2023

ACADEMIC YEAR 2020/2021

BIOCHEMISTRY PAPER II (40TH BATCH)

21.03.2023 **Duration: 3 Hours (9.00am to12.00noon)**

Answer all 10 questions.

Marks allotted to each part are indicated in brackets.

Answer Each Question on Separate Answer Books.

1. A 14-year-old girl admitted to a hospital was dehydrated and was having kussmaul respiration. Her laboratory findings were as follows:

	Patient	Normal
Plasma glucose ($mgdL^{-1}$)	630	
Plasma β-hydroxybutyrate ($mmolL^{-1}$)	13.0	<0.25
Plasma Acetoacetate ($mmolL^{-1}$)	2.8	0.2
Plasma Sodium bicarbonate ($mmolL^{-1}$)	5.0	20 – 25
Blood Urea Nitrogen (BUN) ($mmolL^{-1}$)	12	2.9 -8.9
Blood pH	7.05	
Urinary Sugar	++++	
Urinary Ketone bodies	++++	

1.1 Mention the probable defect in this girl? **(10 Marks)**

1.2 Give the biochemical explanations for the changes in blood

1.2.1 glucose **(35 Marks)**

1.2.2 β-hydroxybutyrate and acetoacetate **(20 Marks)**

1.2.3 bicarbonate and pH **(20 Marks)**

1.3 Explain why the concentration of β-hydroxybutyrate was higher than that of acetoacetate. **(15 Marks)**

2. 2.1 Explain the changes that would occur in Type 1 Diabetes mellitus patients in,

2.1.1 Amino acid level. **(20 Marks)**

2.1.2 Blood Urea Nitrogen (BUN) level. **(20 Marks)**

2.2 Diagrammatically show the metabolism of chylomicron. **(25 Marks)**

2.3 Explain the methods that could be used to reduce the blood cholesterol level. **(35 Marks)**

3. A 12-year-old girl had Von-Gierke's disease. The laboratory investigation revealed, low blood glucose & pH and, high lactate, triglyceride, ketones & free fatty acids. The liver biopsy revealed high glycogen content. Hepatic glycogen structure was normal. The enzyme assay performed on the biopsy tissue revealed very low glucose-6-phosphatase level.

3.1 Explain the changes in

3.1.1 blood glucose **(25Marks)**

3.1.2 lactate **(20 Marks)**

3.1.3 triglyceride **(20 Marks)**

3.1.4 free fatty acids **(20 Marks)**

3.3 Suggest the modification that could be made to the diet of this girl. **(15 Marks)**

4. 4.1 A patient with Hashimoto's thyroiditis was treated with levothyroxine and, at the end of 2 months of treatment she has lost 5.5kg of weight with improvement in thyroid function tests.

4.1.1 Give reasons for the development of the above condition. **(20 Marks)**

4.1.2 Explain how the treatment led to the reduction in body weight. **(25 Marks)**

4.1.3 Explain how thyroid hormone is transported in the blood. **(15 Marks)**

4.1.4 How the T_4 is converted to T_3 in extrahepatic tissues. **(10 Marks)**

4.2 Diagrammatically show the uptake of LDL by extrahepatic tissues. **(30 Marks)**

5. 5.1 A 58-year-old man, experienced central chest pain radiating to the left arm with sweating. The pain disappeared within few hours. Couple of days later the ECG, Troponin T (TnT) and the routine tests were carried out. ECG showed non-specific ST wave changes. The blood test results are as follows:

	Patient	Range
ALT ($U\ L^{-1}$)	45	4-36
AST ($U\ L^{-1}$)	90	8-33
Troponin T ($\mu g\ L^{-1}$)	0.78	<0.01

5.1.1 Suggest the probable condition. **(10 Marks)**

5.1.2 Explain the above test results. **(20 Marks)**

5.1.3 Diagrammatically show how the serum enzymes and proteins of the patient would have changed immediately after the chest pain. **(20 Marks)**

5.2 Explain why administration of aspirin is beneficial to this patient. **(30 Marks)**

5.3 Write short notes on glycerol phosphate shuttle. **(20 Marks)**

6. A 45-year old sedentary man weighing 80kg with the height of 160cm had 35% fat (Reference range for body Fat in men is 11-21%). He was referred to a dietician due to his obesity associated joint pain. His fasting plasma glucose level was 120 $mgdL^{-1}$. His blood total cholesterol level was 385 $mgdL^{-1}$. He was a non-vegetarian who consumed beef and mutton thrice a week and one whole egg daily. He was advised to reduce his body weight within six months of time to have a healthy life.

6.1 Calculate the Body Mass Index of this person. **(10 Marks)**

6.2 Mention the expected ideal weight for his height? **(10 Marks)**

6.3 Calculate the amounts of carbohydrate, fat and protein in grams to be included in his diet plate to have ideal body weight in six months' time while maintaining zero nitrogen balance. **(35 Marks)**

6.4 Outline the dietary advice to control his blood glucose level and to reduce the body fat. **(25 Marks)**

6.5 Explain the merits and demerits of changing from non-vegetarian to vegetarian diet. **(20 Marks)**

7. 7.1 7.1.1 Patients with hypercholesterolaemia are advised to consume only the egg white while avoiding the egg yolk. Comment. **(10 Marks)**

7.1.2 Give the nutritional importance of adding green leaves to the diet of a person on a weight reduction program. **(20 Marks)**

7.2 7.2.1 List the different types of immunoglobulin. **(15 Marks)**

7.2.2 Give the principle of electrophoresis. **(15 Marks)**

7.2.3 Compare the serum protein electrophoretic pattern of a normal individual with that of a multiple myeloma by using a super imposed diagram. **(25 Marks)**

7.3 Explain the basis of salting out and salting in. **(15 Marks)**

8. 8.1 A 40-year-old female of 152cm height and 90kg of weight was presented with intolerance to fatty foods, pain in the right side of the abdomen, yellowish sclera and passage of clay coloured stools. Laboratory investigations were as follows:

		Patient	**Normal Range**
Serum	Total bilirubin ($\mu molL^{-1}$)	24.0	1.71-20.5
	Direct bilirubin ($\mu molL^{-1}$)	16.0	<5.1
	ALP (IUL^{-1})	800	44-147
	ALT (UL^{-1})	20	4-36
Urine	Colour	Deep Yellow	
	Bilirubin	++	
	Urobilinogen	Absent	
Stool	Stercobilinogen	Absent	

8.1.1 Name the probable cause for the above said observations? **(10 Marks)**

8.1.2 Explain the steps involved in the metabolism of bilirubin and its excretion. **(40 Marks)**

8.1.3 Explain the biochemical basis of the above laboratory findings. **(25 Marks)**

8.2 8.2.1 Give reasons for the fat intolerance. **(10 Marks)**

8.2.2 List the consequences that may occur due to long term fat intolerance. **(15 Marks)**

9. 9.1 A 11-month-old baby boy had compulsive urge to bite his lips and fingers. The mother revealed that she had a brother with similar symptoms. Urinary and serum uric acid levels were abnormally high for the age of the baby.

9.1.1 What could be the probable problem in this baby? **(10 Marks)**

9.1.2 Which enzyme activity measurement may be useful to confirm the condition you suggested? **(10 Marks)**

9.1.3 Give reasons for the hyperuricemia and hyperuricosuria. **(20 Marks)**

9.2 A 75-year-old non-diabetic woman had numbness and tingling in her arm. Laboratory results indicated elevated serum methylmalonic acid and megaloblastic anaemia.

9.2.1 Give the specific type of anaemia she has. **(10 Marks)**

9.2.2 Give the biochemical basis for the

9.2.2.1 elevated methylmalonic acid. **(15 Marks)**

9.2.2.2 megaloblastic anaemia. **(20 Marks)**

9.2.2.3 numbness. **(15 Marks)**

10. 10.1. 10.1.1 Define hemochromatosis? **(10 Marks)**

10.1.2 Mention the biochemical tests to be carried out for the diagnosis of hemochromatosis. **(20 Marks)**

10.2 10.2.1 Diagrammatically show and label the different parts of tRNA. **(15 Marks)**

10.2.2 Explain how the structure of tRNA is suited for its function. **(15 Marks)**

10.3 Give the biochemical basis of human ABO blood grouping. **(40 Marks)**